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Public hedge funds☆

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Abstract

Hedge funds managed by listed firms significantly under-perform funds managed by unlisted firms. The under-performance is more severe for funds with low manager deltas, poor governance, and no manager co-investment, or those managed by firms whose prices are sensitive to earnings news. Notwithstanding the under-performance, listed asset management firms raise more capital, by growing existing funds and launching new funds post listing, and harvest greater fee revenues than do comparable unlisted firms. The results are consistent with the view that, for asset management firms, going public weakens the alignment between ownership, control, and investment capital, thereby engendering conflicts of interest.

JEL classification: G11, G12, G23

Keywords: Hedge funds, Asset management, Initial public offering, Agency, Conflicts of interest

1. Introduction

"When a fund management company lists on a stock exchange, its clients are not uniformly delighted. They are aware that potential conflicts of interest can arise that some companies fail to manage."

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–The Financial Times (2012)[1]

Recent years have witnessed a slew of public listings by mega asset management firms including Amundi Group, Man Group, Och-Ziff Capital Management Group, Blackstone Group, and KKR.[2] These publicly listed mega asset managers together managed an impressive $2.38 trillion in 2017. How does the transition to public equity markets impact investment performance? Fund management companies argue that going public allows them to enhance investment performance by better incentivizing their staff through employee stock options and by investing the initial public offering (IPO) proceeds in superior technology and business support. Moreover, listed firms can be operationally more robust than their unlisted competitors given the higher transparency required of listed companies. However, fund investors contend that public listing allows firm founders to sell off their stakes to outsiders, which exacerbates potential conflicts of interest. For asset managers, the transition to public markets weakens the alignment between ownership, control, and investment capital, engendering a rich combination of agency problems, hitherto unexplored in the academic literature, which could have significant implications for the fund investor. In this paper, we shed light on these agency issues by investigating the impact on hedge fund performance when asset management firms go public.

The hedge fund industry is an important and interesting laboratory for studying the impact of initial public offerings in asset management for three reasons.[3] First, hedge funds, both public and private, typically report monthly return data to commercial databases, allowing researchers to cleanly measure investment performance and evaluate the performance implications of the private to public transition.[4] Second, running a comparable analysis on

[1]See also Wall Street Journal (2011).

[2]See, for instance, Bloomberg (2015). By our estimates, at the end of 2013, about 16.68% of hedge fund industry assets were managed by listed firms.

[3]According to BarclayHedge, hedge funds collectively managed close to $3 trillion in assets in 2017. See https://www.barclayhedge.com/research/indices/ghs/mum/HF_Money_Under_Management.html.

[4]One caveat is that hedge funds do not have to report to the databases. Edelman, Fung, and Hsieh (2013) find that funds managed by mega hedge fund firms often do not report to commercial databases.

private equity funds is difficult as performance metrics used in private equity such as internal rate of return (IRR) or investment multiple are measured over a multi-year horizon, effectively precluding researchers from analyzing the performance implications of the transition in a timely fashion. Third, while hedge funds typically charge incentive fees and feature manager co-investment to improve incentive alignment, the potential for agency problems is greater for hedge funds than for mutual funds owing to the complex strategies employed by and the lower level of transparency and disclosure of the former.[5]

Investors in hedge funds and private equity funds (and, to a lesser extent, mutual funds) that are managed by publicly listed firms need to contend with a combination of agency issues: the conflicts that surface between management and fund investors (Agarwal, Daniel, and Naik, 2011; Teo, 2011; Aragon and Nanda, 2017) and the conflicts that arise between firm shareholders and fund investors. A privately held investment firm is often controlled by its founder-owners, who also invest a substantial portion of their net worth in the funds managed by the firm. This engenders alignment between ownership, control, and investment capital. Post-IPO, the founders of the firm sell out to new shareholders who typically do not invest alongside the limited partners, thus separating ownership from investment capital. Furthermore, the founders may not reinvest the substantial proceeds from the IPO in the funds managed by the firm, thereby distancing control from investment capital.[6]

We find substantial differences in expected returns on the portfolios of hedge funds sorted by fund management company listing status that are unexplained by the Fung and Hsieh (2004) seven factors. Hedge funds managed by listed firms under-perform hedge funds managed by unlisted firms by 2.89% per year (t-statistic = 4.73) after adjusting for covariation

[5]Consistent with this view, Ferris and Yan (2009) find economically modest performance differences between mutual funds sorted by firm listing status that are not robust to the risk adjustment methodology. For example, they find that the Fama and French (1993) alpha spread between mutual funds managed by publicly listed firms and those managed by private firms is a modest –2.2 basis points per month and is statistically indistinguishable from zero at the 10% level. Unlike us, Ferris and Yan (2009) do not establish the link between the under-performance and conflicts of interest. Instead, they assume that the under-performance is itself supportive of the agency view.

[6]As a result of the windfall from the IPO, the proportion of the founders' net worth that is co-invested in the funds managed by the firm falls, even if the founders do not redeem from the funds post-IPO.

with the Fung and Hsieh (2004) seven factors. The results are not confined to the smallest funds in our sample and cannot be explained by differences in share restrictions and illiquidity (Aragon, 2007; Aragon and Strahan, 2012), incentives (Agarwal, Daniel, and Naik, 2009), fund age (Aggarwal and Jorion, 2010), fund size (Berk and Green, 2004), return smoothing behavior (Getmansky, Lo, and Makarov, 2004), backfill and incubation bias (Liang, 2000; Fung and Hsieh, 2009; Bhardwaj, Gorton, and Rouwenhorst, 2014), and manager manipulation of fund returns (Agarwal, Daniel, and Naik, 2011; Aragon and Nanda, 2017).

Using a difference-in-differences analysis, we find that, relative to the five-year pre-IPO period, average fund risk-adjusted performance deteriorates by an annualized 8.40% and average firm alpha wanes by an annualized 7.20% during the five-year post-IPO period. Despite the post-event under-performance, public firms harvest annual fee revenues that are \$17.28 million or 54.96% greater than do comparable private firms. Relative to the control group, public firms are able to grow their assets under management (AUM) by \$617.62 million or 77.52% during the same period. The surge in firm AUM stems both from organic growth in existing fund AUM and from the launch of new funds post listing, suggesting that the new capital raised goes toward the marketing of existing and new products.

In line with an agency story that derives from conflicts between control and investment capital, we observe substantial differences in the under-performance for funds sorted on metrics that capture the incentive alignment between management and investors. The alpha spread between funds managed by private versus public firms is smaller for funds with high manager total deltas (Agarwal, Daniel, and Naik, 2009), better governance scores (Ozik and Sadka, 2015), and fund manager personal investment. In keeping with an explanation that relates to conflicts between ownership and investment capital, the short-termist pressures associated with a stock listing (Poterba and Summers, 1995; Graham, Harvey, and Rajgopal, 2005; Asker, Farre-Mensa, and Ljungqvist, 2015) also drive the under-performance of publicly traded asset management firms.[7] We find that firms with high earnings response

[7]A focus on short-term quarterly earnings at publicly listed investment firms can hamper their ability to

coefficients (ERCs) (Ball and Brown, 1968; Easton and Zmijewski, 1989), whose stock prices are more responsive to earnings, under-perform more than do firms with low ERCs. Moreover, consistent with the overall conflicts of interest view, the under-performance is more pronounced for firms that exhibit greater separation of ownership, control, and investment capital post-IPO. Amongst listed firms, those with low insider ownership and whose IPO prospectuses reveal that existing shareholders cash out under-perform more.

The conflicts of interest can translate into fund under-performance via the drive to gather assets post-IPO. Equity markets tend to reward revenue growth, which, for investment firms, generally corresponds to growth in AUM (Pozen and Clay, 2012).[8] Short-termist pressures can also induce excessive asset gathering because asset gathering boosts current fee revenues (or current earnings) at the expense of future returns (or future earnings). We find, consistent with the asset gathering view, that the under-performance is most severe for funds with the lowest liquidity risk exposure (Pástor and Stambaugh, 2003) and, therefore, have the greatest capacity to gather assets. We also find that high ERC firms raise more capital and launch more funds than do low ERC firms.

The endogeneity of firm listing does not explain the under-performance of hedge funds managed by public firms. By analyzing the private to public transition in the event study, we sidestep concerns that time-invariant differences between public and private firms simultaneously explain listing status and fund under-performance. The difference-in-differences methodology ameliorates concerns that observable time-varying differences in firm characteristics drive our findings. To cater for unobserved time-varying differences between public and private firms, we run an instrumental variables analysis with the supply of investment capital at firm founding as the instrument and find that the impact of listing on fund performance is even stronger after instrumenting for listing status. Our choice of instrument

attack long-horizon mispricings (Stein, 2005), thereby limiting investment opportunity and reducing alpha.

[8]Man Group's strategy is emblematic of this. According to Man Group finance director Kevin Hayes, "the Board's point of view is that at its essence the Man Group's strategy is a growth strategy. We think that's why people invest in us. ... And when we're looking therefore at each aspect of our business, we have to be able to grow it. We have to be able to scale it." See Pozen and Clay (2012, p. 6).

follows Asker, Farre-Mensa, and Ljungqvist (2015) and is robust to alternative specifications.

The results in this paper challenge the view that asset management firms list to enhance investment performance. In doing so, we resonate with three strands of research on hedge funds. The first strand examines agency problems and finds that some hedge funds inflate their December returns (Agarwal, Daniel, and Naik, 2011), take on excessive liquidity risk (Teo, 2011), and strategically delay reporting poor performance (Aragon and Nanda, 2017).[9] Our findings indicate that the process of going public heightens conflicts of interest, which are in turn associated with poorer performance. A second strand sheds light on the drivers of alpha. We find that, just like motivated (Agarwal, Daniel, and Naik, 2009), emerging (Aggarwal and Jorion, 2010), distinctive (Sun, Wang, and Zheng, 2012), and attentive (Lu, Ray, and Teo, 2016) hedge funds, those managed by private firms out-perform. The third strand uncovers strong direct (Yin, 2016) and indirect (Lim, Sensoy, and Weisbach, 2016) incentives that drive managers to raise capital. Our results suggest that public firms are even more motivated to gather assets.

This paper enriches the literature on initial public offerings. Going public crimps industry competitor performance (Hsu, Reed, and Rocholl, 2010), biases issuers of credit ratings (Kedia, Rajgopal, and Zhou, 2014), hurts firm internal innovation (Bernstein, 2015), and reduces the sensitivity of corporate investment to opportunities (Asker, Farre-Mensa, and Ljungqvist, 2015). Yet, little is known about the effect of going public on fund investment performance. Our work addresses this important gap. Our findings are distinct from papers that find that IPO firms suffer from poor long-run post-issue operating performance (Jain and Kini, 1994) and stock returns (Loughran and Ritter, 1995). Unlike those papers, which analyze the conflicts between shareholders and management (Jensen and Meckling, 1976; Jensen, 1989), we focus on the conflicts between fund investors and management / shareholders. We show that while listed asset managers deliver lower returns, which hurt fund

[9]Jorion and Schwarz (2014) argue that the discontinuity at zero in the hedge fund net return distribution shown by Bollen and Pool (2009) is not evidence of manager manipulation.

investors, they are able to grow fee revenues, which benefits shareholders.

Our findings echo work on ownership-driven conflicts of interest at mutual funds. For example, Gaspar, Massa, and Matos (2006) find evidence of strategic cross-fund subsidization within mutual fund families. Golez and Marin (2015) show that mutual funds owned by banks provide price support for their affiliated banks through their trading activities. Banks in turn leak valuable information derived from their lending activities to their affiliated mutual funds (Massa and Rehman, 2008) and assign favorable ratings, through their analysts, to the stocks that are held by those mutual funds (Mola and Guidolin, 2009). Unlike those studies, we investigate conflicts of interest stemming from changes in the ownership structure of asset management firms and analyze how those changes relate to fund investors.

Our work complements a nascent literature on ownership stakes in hedge funds, which reports conflicting results on the performance of hedge funds with external owners. On one hand, Mullally (2017) finds that hedge funds that sell significant ownership stakes to outsiders do not under-perform. He contends that external owners in general have strong incentives to monitor their funds. On the other hand, Yan and Zheng (2017) show that conditional on those outside owners being financial firms, hedge funds subsequently under-perform, which they attribute to a conflicts of interest story. In our sample, we exclude firms that go public simply because they are bought out by listed companies. Therefore, our results are not driven by the external owner or by the financial firm affiliation effect. We argue that an IPO offers a more robust setting for investigating conflicts of interest in hedge fund firms given that the new minority shareholders of a publicly listed firm typically neither invest in the funds under management nor have control rights over the firm. Conversely, in an ownership transfer, the new stakeholder often acquires control rights while simultaneously supplying capital to the funds managed by the firm.[10]

The remainder of this paper is organized as follows. Section 2 describes the data and methodology. Section 3 reports the empirical results, and Section 4 presents a battery of

[10]See, for example, the seed relationships described in Cohen and Delacey (2005, p. 7).

robustness tests. Section 5 concludes.

2. Data and methodology

We evaluate hedge funds using monthly net of fee returns and assets under management data of live and dead hedge funds reported in the TASS, Hedge Fund Research (HFR), and BarclayHedge data sets from January 1994 to December 2013. Because TASS, HFR, and BarclayHedge started distributing their data in 1994, the data sets do not contain information on funds that died before January 1994. This gives rise to survivorship bias. We mitigate this bias by focusing on data from January 1994 onward.

Our fund universe has a total of 30,509 hedge funds, of which 12,380 are live funds and 18,129 are dead funds. Due to concerns that funds with multiple share classes could cloud the analysis, we exclude duplicate share classes from the sample.[11] This leaves a total of 16,592 hedge funds, of which 5,947 are live funds and 10,645 are dead funds at the end of our sample period. The funds are roughly evenly split between TASS, HFR, and BarclayHedge. While 5,547 funds appear in multiple databases, many funds belong to only one database. There are 3,597, 3,446, and 4,002 funds unique to the TASS, HFR, and BarclayHedge databases, respectively. This highlights the advantage of obtaining data from more than one source. In addition to monthly return and size information, our sample captures data on fund characteristics such as management fee, performance fee, redemption period, lock-up period, investment style, leverage indicator, high-water mark indicator, and fund age.[12]

We collect the fund management companies' public listing status from several sources: Standard & Poor's (S&P) Capital IQ, the Securities and Exchange Commission (SEC) In-

[11] Inferences do not change when we include multiple share classes of the same fund in the analysis. To merge databases, we follow the procedure outlined in the Appendix of Joenväärä, Kosowski, and Tolonen (2017).

[12] To ameliorate the impact of return outliers, we trim the hedge fund returns in our sample at the 99.5th and 0.5th percentiles. The baseline results are virtually unchanged when we use the original returns reported in the databases or when we winsorize the returns at the 99.5th and 0.5th percentiles.

vestment Adviser Public Disclosure website, Factiva, and the fund management companies' websites.[13] For each fund management company, we perform a search in S&P Capital IQ and SEC's Investment Adviser Public Disclosure, which provide information about the company's current and prior corporate parents. Once we identify a parent and subsidiary relation, we obtain the effective public listing date for the fund management company by checking the M&A/Private Placements section in S&P Capital IQ, conducting a Factiva news search, and perusing the corporate history from the fund management company's website.

Panel A of Table 1 provides summary statistics on the number of listed firms as well as the number of hedge funds and the assets that they manage by year. While the number of listed fund management companies is small relative to the number of unlisted fund management companies, listed fund management companies manage a growing number of hedge funds and pool of assets. In 1994, only 12 listed firms were managing 39 hedge funds and $2.55 billion or 4.02% of industry assets. In 2013, the number of listed firms has grown to 113. These firms manage 856 hedge funds and $199.34 billion or 16.68% of industry assets, a significant increase relative to the start of the sample period.

[Insert Table 1 near here]

Following Joenväärä, Kosowski, and Tolonen (2017), we classify hedge funds into 12 investment styles: Commodity Trading Advisor, Emerging Markets, Event Driven, Global Macro, Long Only, Long/Short, Market Neutral, Multi-Strategy, Relative Value, Sector, Short Bias, and Others. Panel B of Table 1 reports the number and percentage of funds managed by listed versus unlisted firms stratified by investment style.[14] It indicates that, relative to private hedge funds, a greater proportion of public hedge funds are Long Only and Multi-Strategy funds and a smaller proportion are Commodity Trading Advisor and

[13] See http://www.adviserinfo.sec.gov/IAPD/Content/Search/iapd_Search.aspx for the SEC's Investment Adviser Public Disclosure website.

[14] The total number of funds reported in Panel B of Table 1 (15,351) is smaller than that for the full sample (16,592) as we exclude funds with missing investment strategy information, funds managed by firms acquired by listed entities, and funds for which firm listing status is unclear.

Event Driven funds.

Our firm sample covers a broad spectrum of fund management companies including large asset management houses that also manage private equity funds and mutual funds. This allows us to shed light on the impact of public listing on the asset management industry in general. One concern is that, for some of these firms, their hedge fund assets could be a relatively small part of their business. Consequently, the impact of hedge fund performance, fee revenues, and AUM on these firms can be relatively muted. To ameliorate such concerns, as a robustness test, we follow Brunnermeier and Nagel (2004) and discard firms for which hedge fund assets make up only a small part of their aggregated institutional portfolio. We first check whether a firm is registered as an investment adviser with the SEC. Registration is a prerequisite for conducting non-hedge fund business. If a firm is not registered, we include it in our pure play sample. If a firm is registered, we obtain its registration documents (Form ADV). For a registered firm to be included in our pure play hedge fund firm sample, we require that it charges performance-based fees and that at least 50% of its clients are "Other pooled investment vehicles (e.g., hedge funds)" or "High net worth individuals." This leaves a total of 96 listed and 1,888 unlisted pure play firms at the end of the sample period. In results that are available upon request, we find that our baseline results prevail when we analyze only pure play hedge fund firms.

Hedge fund data are susceptible to many biases (Liang, 2000; Fung and Hsieh, 2009). These biases stem from the fact that inclusion in hedge fund databases is voluntary. As a result, a self-selection bias exists. For instance, funds often undergo an incubation period during which they rely on internal funding before seeking capital from outside investors. Incubated funds with successful track records then go on to list in various hedge fund databases while the unsuccessful funds do not, resulting in an incubation bias. Separate from this, when a fund is listed on a database, it often includes data prior to the listing date. Again, because successful funds have a strong incentive to list and attract capital inflows, these backfilled returns tend to be higher than the non-backfilled returns. In our analysis, we repeat the

tests after dropping the first 24 months of return data from each fund to ensure that the results are robust to backfill and incubation bias. To fully address concerns about backfill bias raised by Bhardwaj, Gorton, and Rouwenhorst (2014) and others, we also redo the tests after removing all return observations that have been backfilled prior to fund listing date.

Throughout this paper, we model the risks of hedge funds using the Fung and Hsieh (2004) seven-factor model. The Fung and Hsieh factors are the excess return on the S&P 500 index (SNPMRF); a small minus big factor (SCMLC) constructed as the difference between the Russell 2000 and the S&P 500 indexes; the yield spread of the US ten-year Treasury bond over the three-month Treasury bill, adjusted for duration of the ten-year bond (BD10RET); the change in the credit spread of Moody's BAA bond over the ten-year Treasury bond, also appropriately adjusted for duration (BAAMTSY); and the excess returns on portfolios of lookback straddle options on currencies (PTFSFX), commodities (PTFSCOM), and bonds (PTFSBD), which are constructed to replicate the maximum possible return from trend following strategies (Fung and Hsieh, 2001) on their respective underlying assets. These seven factors have been shown by Fung and Hsieh (2004) to have considerable explanatory power on hedge fund returns.

3. Empirical results

3.1. Tests of fund performance

To begin, we test for differences in risk-adjusted performance between funds managed by listed and unlisted management companies. Every year, starting in January 1994, two hedge fund portfolios are formed by sorting funds on management company listing status. The post-formation returns on these two portfolios over the next 12 months are linked across years to form a single return series for each portfolio. We then evaluate the performance of the portfolios relative to the Fung and Hsieh (2004) model.

The results, reported in Panel A of Table 2, reveal substantial differences in expected returns, on the portfolios sorted by management company listing status, that are unexplained

by the Fung and Hsieh (2004) seven factors. Hedge funds managed by listed companies under-perform those managed by unlisted firms by a statistically significant but modest 1.89% per year (t-statistic = 3.13). After adjusting for covariation with the factors from the Fung and Hsieh (2004) model, the spread increases to an economically significant 2.89% per year (t-statistic = 4.73).[15] As in the rest of the paper, we base statistical inferences on White (1980) heteroskedasticity-consistent standard errors. Because hedge funds with investor capital below $20 million perhaps are not relevant to large institutional investors, we conduct the portfolio sort on the sample of hedge funds with at least $20 million of AUM. The results reported in Panel B of Table 2 indicate that our findings are not driven by small funds.[16]

[Insert Table 2 near here]

Fig. 1 complements the results from Panel A of Table 2. It illustrates the monthly cumulative abnormal returns (CARs) from the portfolio of funds managed by listed firms (Portfolio A) and the portfolio of funds managed by unlisted firms (Portfolio B). CAR is the cumulative difference between a portfolio's excess return and its factor loadings (estimated over the entire sample period) multiplied by the Fung and Hsieh (2004) risk factors. The CARs in Fig. 1 indicate that Portfolio A consistently under-performs Portfolio B over the entire sample period and suggest that the under-performance of funds managed by listed firms is not peculiar to a particular year.

[Insert Fig. 1 near here]

Concerns could arise that the portfolio sort results are driven by shareholder activists as activists that are managed by listed firms could be less willing to exert strong pressure

[15]The portfolio sort results are robust to value weighting the funds within each portfolio. The risk-adjusted spread for the value-weighted sort is 2.75% per annum (t-statistic = 4.20).

[16]The portfolio sort results are not driven solely by the under-performance of funds launched post IPO by listed firms. We redo our portfolio sort with only funds that were conceived prior to firm listing and find that these funds post firm IPO under-perform funds managed by unlisted firms by 2.54% per year after adjusting for risk (t-statistic = 2.72). Funds launched post-IPO under-perform funds launched pre-IPO, but the performance spread is statistically indistinguishable from zero.

on portfolio companies to make shareholder-friendly changes given that they themselves are vulnerable to shareholder activism. To address such concerns, we identify shareholder activist funds in our sample based on strategy name, substrategy name, fund name, and fund investment strategy description. In total, 95 shareholder activist funds are in our sample. After removing shareholder activists, we find that funds managed by listed firms still underperform those managed by unlisted firms by 2.85% per annum (t-statistic = 4.66) after adjusting for risk.

To further test the performance difference between funds managed by listed and unlisted management companies, we estimate the following pooled ordinary least squares (OLS) regression:

$$ALPHA_{im} = a + bLISTED_{im} + cMGTFEE_i + dPERFFEE_i + eNOTICE_i + fMININV_i + g\log(SIZE_{im-1}) + hAGE_{im} + \sum_k p^k STYLEDUM_i^k + \sum_l q^l YEARDUM_{im}^l + \epsilon_{im}, \quad (1)$$

where *ALPHA* is fund monthly abnormal return after stripping away covariation with the Fung and Hsieh (2004) seven factors, *LISTED* is an indicator variable that takes a value of one when a fund is managed by a listed firm and a value of zero otherwise, *MGTFEE* is fund management fee in percentage, *PERFFEE* is fund performance fee in percentage, *NOTICE* is fund redemption notification period in months, *MININV* is fund minimum investment in millions of US dollars, *SIZE* is fund AUM in millions of US dollars, *AGE* is fund age in decades, *STYLEDUM* is the fund style dummy, and *YEARDUM* is the year dummy. Fund alpha is one-month abnormal return from the Fung and Hsieh (2004) model, with the factor loadings estimated over the prior 24 months.[17] We also estimate the analogous regression on raw monthly fund returns to ensure that our findings are not artefacts of the risk adjustment methodology. We base statistical inferences on robust standard errors that are clustered by

[17]Inferences do not change when we use factor loadings estimated over the past 36 months to calculate alpha instead.

fund, which are White (1980) standard errors that adjust for dependence at the fund level.

The results from the cross-sectional regression analysis, reported in Columns 1 to 4 of Table 3, corroborate the findings from the portfolio sorts. The coefficient estimate on *LISTED* in the alpha regression reported in Column 4 indicates that, controlling for other factors that could explain fund performance, funds managed by listed companies under-perform funds managed by unlisted companies by 2.42% per annum after adjusting for risk. Inferences do not change when we estimate the regression on raw returns suggesting that our prior findings are not driven by our risk adjustment technology. The coefficient estimates on the control variables accord with the extant literature. Higher powered incentives or performance fees (Agarwal, Daniel, and Naik, 2009) and longer redemption notice periods (Aragon, 2007) are associated with superior performance, and fund age (Aggarwal and Jorion, 2010) is linked to poorer performance. The impact of fund size on performance is more ambiguous. While size is associated with lower returns (Berk and Green, 2004), it is also linked to higher alphas.[18]

[Insert Table 3 near here]

To check for robustness, we estimate Fama and MacBeth (1973) regressions in place of the OLS regressions. First, we run cross-sectional regressions for each month. Then, we report the time series averages of the coefficient estimates and use the time series standard errors of the average slopes to draw inferences. The Fama and MacBeth regressions control for correlation in residuals across different firms within the same month. We compute Newey and West (1987) standard errors with a three-month lag to adjust for dependence across time.[19] The Fama and MacBeth (1973) results reported in Columns 5 to 8 of Table 3 echo our previous findings and indicate that they are robust to alternative model specifications.

[18]Diseconomies of scale at the firm level do not explain our findings. In unreported results (available upon request), we show that the pooled OLS regression findings are robust to including the log of lagged firm AUM as an additional independent variable. Our findings are also robust to including the log of fund age as opposed to fund age as one of the independent variables.

[19]Inferences do not change when we compute Newey and West (1987) standard errors with a longer 24-month lag instead. The coefficient estimates on *LISTED* are still significant at the 1% level for both the univariate and the multivariate Fama and MacBeth regressions with fund alpha as the dependent variable.

One concern is that funds managed by listed firms could take on less leverage than do funds managed by unlisted firms. This can explain the under-performance of the former relative to the latter. To address this concern, we reestimate the Eq. (1) regressions with fund information ratio in place of fund alpha. Information ratio is fund alpha divided by the standard deviation of fund residuals from the Fung and Hsieh (2004) model estimated over the past 24 months. In results that are available upon request, we find that the coefficient estimates on *LISTED* in the OLS regressions on information ratio are negative and statistically significant at the 1% level. After controlling for the other factors that could drive fund information ratio, funds managed by listed firms deliver information ratios that are on average 0.228 lower than do funds managed by unlisted firms. Inferences do not change when we estimate Fama and MacBeth (1973) regressions on fund information ratio.

3.2. Event study

To complement the baseline portfolio sorts, we conduct an event study to investigate fund performance and AUM before and after firm listing. We choose as the event window the period starting 60 months prior to the IPO and ending 60 months after the IPO.[20] To be included in the sample, a fund must have monthly return information during the period that starts 36 months pre-IPO and ends 36 months post-IPO. This leaves 27 funds that belong to 16 firms with sufficient return information. To account for endogeneity concerns driven by observable differences between listed and unlisted firms, we match event hedge funds with non-event hedge funds based on fund performance and AUM in the 36-month pre-IPO period and conduct a difference-in-differences analysis. For example, in the fund alpha analysis, event funds are matched to non-event funds by minimizing the sum of the absolute differences in monthly fund alpha in the 36-month pre-IPO period. Panel A of Table 4 reports differences in fund alpha and AUM before and after the IPO relative to the matched sample. We also match event firms with non-event firms based on firm performance, firm

[20]Our difference-in-differences results are robust to using an event window that starts 48 months prior to the IPO and ends 48 months after the IPO.

AUM, firm revenue, and number of funds per firm, and we report the results from difference-in-differences analyses of these firm attributes in Panel B of Table 4.[21]

[Insert Table 4 near here]

The results reported in Table 4 indicate that, relative to the five-year period before IPO and to a matched sample of funds, fund risk-adjusted performance deteriorates by an annualized 8.40% during the five-year period following the IPO.[22] The reduction in fund performance is economically meaningful and statistically significant at the 1% level.[23] At the same time and relative to comparable firms, listed firm risk-adjusted performance wanes by an annualized 7.20%. These results suggest that the drop in performance could be driven more by the smaller funds managed by listed firms.

Do the lower alphas of listed firms translate into lower fee revenues for these asset management companies? We find that, despite the deterioration in performance, relative to their unlisted competitors, listed firms harvest annual fee revenues that are $17.28 million or 54.96% greater post-listing. This is because compared with the control group, they grow their AUM by $617.62 million or 77.52% during the same period. The surge in firm AUM stems both from organic growth in existing fund AUM and from the launch of new funds post

[21]Inferences do not change when we match event and non-event funds based on fund age and analyze fund alpha.

[22]To reconcile the results from the event study (Table 4) with those of the portfolio sort (Table 2), we rerun the portfolio sort with only funds from the event study sample, i.e., funds with at least 36 months of return information pre- and post-firm IPO. The results indicate that for this group of funds, the alpha spread between funds managed by unlisted firms and those managed by listed firms is 10.98% per annum. This is consistent with the magnitude of the alpha spread reported in Table 4.

[23]Concerns could arise that the significant difference-in-differences result may be driven by the 29 basis point monthly alpha spread between the treatment and control funds in the pre-event period. This performance spread is statistically indistinguishable from zero at the 10% level. Nonetheless, to address such concerns, we perform an alternative two-stage matching procedure. First, we limit the sample of possible matching funds to those that lie within the 10th percentile of the funds that are closest to the treatment fund based on average monthly alpha in the pre-event period. Next, within this group of funds, we choose the fund that minimizes the sum of the absolute differences in monthly fund alpha. The 10th percentile cutoff is chosen from a set of possible cutoffs in 5% increments, i.e., {5, 10, 15, ..., 95}, to minimize the alpha spread between the treatment and control group in the pre-event period. This two-stage matching procedure reduces the pre-event alpha spread to a modest 9 basis points per month (t-statistic = 0.48). Moreover, the difference-in-differences is still significant at -70 basis points per month (t-statistic = -2.40). These results are available upon request.

listing. After listing, existing fund AUM ratchets up by $84.41 million or 31.26% relative to comparable funds. At the same time, the number of funds per firm increases from 4.26 to 8.21, which is 4.19 funds per firm greater than for comparable firms. This suggests that the capital raised via the IPO goes toward the marketing of existing products and the launching of new products.

Are listed firms more likely to conceive additional hedge funds after controlling for other factors that drive fund launch? To investigate, we estimate probit regressions on the probability of launching a new hedge fund in a given year. We include as independent variables an indicator variable for whether a firm is listed, as well as controls for past firm performance over the previous year, the number of funds already launched by the firm, standard deviation of monthly firm returns over the previous year, aggregate firm flow over the previous year, firm management fee, firm performance fee, firm notice period, firm minimum investments, firm age, and the log of firm size. Firm management fee is simply the value-weighted average management fee of the funds managed by the firm. The other firm attributes are constructed analogously.

The results reported in Table 5 suggest that firms are more likely to raise additional funds post-IPO. The marginal effect from the regression with firm return as a control variable indicates that listing increases the probability that a firm will launch a new fund by 3.27 percentage points. In any given year, the unconditional probability that a firm will launch a new fund is 10.67 percentage points. So, listing increases the chance that a firm will raise a new fund by 30.65%. The coefficient estimates on the other independent variables yield interesting insights. They indicate that firms that are larger, are younger, set more investor-friendly redemption notification terms, and conceived many funds before are more likely to launch additional funds.

[Insert Table 5 near here]

3.3. Conflicts between investment capital and control

The results in Subsection 3.2 are consistent with the view that principal-agent problems drive fund behavior around firm IPOs. To investigate further, we stratify funds based on metrics that moderate conflicts between fund management and investors at hedge funds and then redo the portfolio sorts. We condition on past fund manager total delta. Agarwal, Daniel, and Naik (2009) argue that managers who are operating close to their high water-marks, and hence have higher manager total deltas, are more aligned with their investors. We also condition on the Ozik and Sadka (2015) governance measure, which is based on whether a fund is an onshore fund, features a high-water mark, is registered with the SEC, was audited in the past, and employs a top auditor or legal counsel.[24] As per Ozik and Sadka (2015), we group funds into high aggregate governance funds, i.e., funds with aggregate governance scores greater than or equal to four (out of five), and low aggregate governance funds, i.e., funds with aggregate governance scores less than or equal to one (out of five). We further condition on fund manager personal investment, which aligns manager interests with those of investors and has been used by researchers to study conflicts of interest in hedge funds (see, e.g., Brown, Goetzmann, Liang, and Schwarz (2009)). Higher manager total deltas, better fund governance, and manager personal investment should ameliorate the agency problems faced by listed asset management firms and, therefore, help narrow the investment performance gap between listed and unlisted firms.

We report in Panels A to C of Table 6 the results from the baseline portfolio sorts after stratifying funds by the above-mentioned metrics. We find that the alpha spreads between funds managed by listed and unlisted firms are smaller for funds with greater incentive alignment, i.e., funds with high manager total deltas in the previous year, better governance, and manager co-investment. These results lend credence to the view that the under-performance of listed firms is linked to the conflicts between control and investment capital.

[24] See http://en.wikipedia.org/wiki/List_of_100_largest_law_firms_by_revenue for the top law firms and http://www.accountingmajors.com/accountingmajors/articles/top100.html for the top accounting firms.

[Insert Table 6 near here]

3.4. Conflicts between investment capital and ownership

Is the under-performance of funds managed by listed firms also linked to the conflicts between fund investors and firm shareholders? An emphasis on short-term quarterly earnings at public investment firms would hamper their ability to correct long-horizon mispricings in the market (Stein, 2005), thereby limiting the investment opportunity set and reducing alpha.

To test, we follow Asker, Farre-Mensa, and Ljungqvist (2015) and compute earnings response coefficients (Ball and Brown, 1968; Easton and Zmijewski, 1989). ERCs measure the sensitivity of stock returns to firm earnings. We compute ERCs using firm-level regressions for all listed firms with at least eight quarters of earnings information from the Institutional Brokers' Estimate System (I/B/E/S). To increase the precision of our estimates and conserve the number of observations, firm ERCs are estimated using information that span the full sample period. If short-termism explains fund under-performance, then the under-performance should be concentrated in funds managed by firms with high ERCs.

We find that high ERC firms drive the under-performance of funds managed by listed firms. The results reported in Table IA1 in the Internet Appendix indicate that after adjusting for covariation with the Fung and Hsieh (2004) seven factors, the high ERC portfolio (Portfolio A1) under-performs the unlisted portfolio (Portfolio B) by 2.68% per year (t-statistic = 3.13) and the low ERC portfolio (Portfolio A2) delivers a risk-adjusted return that is statistically indistinguishable from that of the unlisted portfolio.

3.5. Separation of investment capital, ownership, and control post-IPO

If the separation of investment capital, ownership, and control truly drives the under-performance of funds managed by listed firms, the results should be strongest for funds belonging to public firms in which the founders unloaded most of their stakes. In such firms, the level of insider ownership should be low. Therefore, we argue that public firms with few

insider owners and few closely held shares experience the greatest separation of ownership, control, and investment capital. Next, we sort funds managed by listed firms based on the number of insider owners and the number of closely held shares. We obtain data on insider owners from Form ADV Schedule A and B and information on closely held shares from Datastream. We define an insider owner as a member of the fund management team who owns, either directly or indirectly, at least 5% of the fund management company.

The sort results reported in Panels D and E of Table 6 indicate that, relative to funds managed by unlisted firms, hedge funds managed by listed firms with no insider owners under-perform by 2.58% per annum (t-statistic = 3.16) after adjusting for risk, and those managed by listed firms with at least one insider owner out-perform by 0.05% per annum (t-statistic = 0.02) after adjusting for risk. Similarly, relative to funds managed by unlisted firms, funds managed by listed firms with few closely held shares (as a proportion of the total number of shares outstanding) under-perform more than do funds managed by listed firms with many closely held shares. The risk-adjusted under-performance of the former is 3.44% per annum (t-statistic = 5.07) and that of the latter is 2.31% per annum (t-statistic = 2.67). These results buttress the conflicts of interest view.

We also sort funds managed by listed firms based on whether they reveal in their IPO prospectuses that their existing shareholders will cash out. We obtain IPO prospectuses from the Perfect Information filings database. Out of the 41 investment firms for which we have prospectuses, 23 firms reveal either directly or indirectly that existing shareholders will cash out during the IPO. The results reported in Panel F of Table 6 indicate that, in line with the conflicts of interest explanation, the under-performance is driven by listed firms whose existing shareholders cashed out during the IPO. After adjusting for risk, funds managed by listed firms in which existing shareholders cashed out under-perform funds managed by unlisted firms by 4.58% per year (t-statistic = 2.86), and those managed by listed firms in which existing shareholders did not cash out under-perform their unlisted competitors by a modest 0.27% per year (t-statistic = 0.35).

3.6. Asset gathering

How do the conflicts of interest that surface post-IPO engender fund under-performance? Fund management companies that go public can under-perform as they are focused on gathering assets and therefore either are less motivated to build on their successful track records (because they are busy exploiting them) or are simply distracted by the demands associated with growing their businesses. Researchers have shown that manager motivation (Agarwal, Daniel, and Naik, 2009; Aggarwal and Jorion, 2010) and inattention (Lu, Ray, and Teo, 2016) impact performance. Recent work has argued that, in the absence of personal capital, strong direct (Yin, 2016) and indirect (Lim, Sensoy, and Weisbach, 2016) incentives drive hedge fund managers to raise capital. Equity markets tend to reward revenue growth, and, for investment firms, revenue growth generally corresponds to growth in AUM. Moreover, capital markets value stable and predictable earnings. This can encourage asset management firms to trade volatile performance fee revenues for relatively stable management fee revenues by growing AUM (Pozen and Clay, 2012). We find from the results in Table 4 that, relative to their unlisted counterparts, listed firms raise more capital and are more likely launch new funds.

We argue that for the asset gathering view to hold, under-performance must be concentrated among funds that have the greatest scope or potential for gathering assets. Hedge funds that take on lower liquidity risk are less susceptible to capacity constraints (Berk and Green, 2004) and, therefore, have greater potential for gathering assets. We thus sort funds based on their liquidity risk as captured by fund historical Pástor and Stambaugh (2003) liquidity beta and redo the baseline portfolio sorts. Fund historical liquidity beta is estimated in the presence of the factors from the Fung and Hsieh (2004) model, using the past 24 months of data. Five hedge fund groups are formed every January 1, starting in 1996, based on fund historical Pástor and Stambaugh liquidity beta. For each of these five groups, hedge funds are sorted into two portfolios based on fund management company listing status. The post-formation returns on these ten portfolios during the next 12 months are linked across

years to form a single return series for each portfolio.

Table IA2 in the Internet Appendix reports the baseline portfolio sorts on five groups of funds stratified by fund historical Pástor and Stambaugh (2003) liquidity beta. Consistent with the asset gathering view, the performance differential between funds managed by listed firms and those managed by unlisted firms is greatest for funds that take on lower liquidity risk and, therefore, have fewer constraints on growth. After adjusting for covariation with the Fung and Hsieh (2004) seven factors, the under-performance of the funds managed by listed firms (relative to those managed by unlisted firms) is 6.66% per annum (t-statistic = 4.81) for funds in the lowest liquidity beta quintile and only 2.89% per annum (t-statistic = 1.64) for funds in the highest liquidity beta quintile.

The advantage of our setup is that it captures ex ante the intent to raise capital. Actual capital raised ex post is less useful for our purposes because it is both a function of past fund performance (Agarwal, Green, and Ren, 2018) via the flow-performance relation and a determinant of future fund performance via capacity constraints. Nonetheless, in untabulated results, we also sort funds managed by listed firms into portfolios based on the firm annualized AUM percentage growth post-IPO and find that the under-performance is concentrated in funds managed by firms that have aggressively raised capital post-IPO. Funds managed by firms with above median AUM growth post-IPO under-perform funds managed by unlisted firms by 3.21% per annum (t-statistic = 3.96) after adjusting for risk. Conversely, funds managed by firms with below median AUM growth post-IPO under-perform funds managed by unlisted firms only by 0.99% per annum (t-statistic = 0.84) after accounting for risk.

Short-termist pressures can also induce excessive asset gathering because asset gathering boosts current fee revenues (or current firm earnings) at the expense of future returns (or future earnings). In results that are available upon request, we find using a probit regression on the probability of fund launch post-firm listing that, in any given year, high ERC firms are 37% more likely to launch new funds than are low ERC firms. Furthermore, high ERC firms raise more capital than do low ERC firms. In spite of their under-performance, high

ERC firms manage on average $789.47 million more than do low ERC firms.

3.7. Endogeneity of firm listing status

Does the endogeneity of firm listing engender the under-performance of hedge funds managed by public firms? Systematic differences can exist between firms that list and those that do not. These differences could impact both the propensity to list and fund investment performance. The event study in Subsection 3.2., by analyzing within-firm variation in listing status, addresses concerns that the spread in investment performance could be driven by time-invariant differences between private and public firms. Furthermore, the difference-in-differences methodology that we employ in the event study allows us to ameliorate concerns that observed time-varying differences between listed and unlisted firms explain our results.

Still, the event study leaves open the possibility that unobserved time-varying differences between public and private firms could simultaneously affect the decision to go public and fund investment performance. To address this concern, we conduct an instrumental variables analysis. The instrument that we use, i.e., firm strategy flow at founding, is motivated by the Asker, Farre-Mensa, and Ljungqvist (2015) choice of venture capital supply at founding to instrument for firm listing status. Firm strategy flow at founding is the strategy flow of the first fund conceived by the firm in the two-year period post-firm inception.[25] We argue that the ability to attract capital at inception allows a firm to quickly reach critical mass and sets the stage for a possible public listing several years later. The first-stage results in Column 1 of Table 7 confirm this prediction. The supply of capital around the time of firm founding is a positive and significant predictor of a firm's listing status with an F-statistic of 31.81.

[Insert Table 7 near here]

[25] Asker, Farre-Mensa, and Ljungqvist (2015) use as their instrument the total number of firms receiving first-round venture capital funding in a firm's headquarter state two years after a firm was funded. Likewise, we use firm strategy flow in the two-year period after firm inception. We obtain similar inferences when we use firm strategy flow during the one-year period before inception or firm strategy flow during the one-year period after inception as alternative instruments.

The exclusion restriction is that conditional on covariates, firm strategy flow in the two-year period after inception affects fund investment performance only through its impact on a firm's listing status. One concern is that early firm strategy flow can drive future strategy returns via strategy-level capacity constraints (Naik, Ramadorai, and Strömqvist, 2007). However, the median firm age at listing in our sample of eight years helps alleviate this concern.[26] Capital accumulation between six to eight years earlier should have little impact on a fund's investment performance today. As in Acemoglu, Johnson, and Robinson (2001) and Glaeser, Kerr, and Kerr (2015), we rely on the separation of time to motivate the exclusion requirement. In unreported results, we find that higher strategy flow over the last two years is not a reliable harbinger of lower future strategy returns. Therefore, our use of strategy flow as opposed to AUM allows us to sidestep concerns related to strategy-level capacity constraints.

In Columns 2 and 3 of Table 7, we report the second-stage results for the fund return and alpha equations, respectively. After instrumenting for firm listing status, hedge funds managed by publicly listed firms continue to under-perform those managed by private firms. A comparison with the equivalent naïve OLS estimates in Columns 4 and 5 of Table 7 indicates that the point estimates are larger in absolute terms after instrumenting for listing status. These findings suggest that endogeneity is unlikely to drive our results.

4. Robustness tests

In this section, we conduct a battery of robustness tests to ascertain the strength of our empirical results.

4.1. Backfill bias

Funds managed by unlisted firms can backfill their returns more often than do funds managed by listed firms. In response to concerns about backfill bias raised by Bhardwaj,

[26]For the instrumental variables analysis, to accommodate our choice of instrument, we remove all firms that list within two years of firm inception.

Gorton, and Rouwenhorst (2014) and others, we confine the analysis to TASS and HFR funds for which we have the date that the fund listed on the databases (only TASS and HFR provide this information). Next, we redo the baseline Table 2 portfolio sort for this subset of funds and for those returns at or after the respective fund listing date. As not enough funds report returns post-listing in the cross section during the earlier years, we perform the analysis for the period after 1996. As shown in Panel A of Table 8, our inferences remain unchanged when we control for backfill bias in this fashion. Inferences remain unchanged when, as an alternative, we remove the first 24 months of returns for all funds to adjust for backfill and incubation bias.

[Insert Table 8 near here]

The Eq. (1) regression results are robust to adjusting for backfill bias. When we estimate the OLS and Fama-MacBeth regressions on the TASS and HFR fund performance post-listing (on the databases), the coefficient estimates on *LISTED* are economically meaningful and statistically significant at the 1% level. Inferences do not change when we include BarclayHedge funds after removing the first 24 months of returns in the regression sample. These results are available upon request.

4.2. Serial correlation

Serial correlation in fund returns could arise from linear interpolation of prices for infrequently traded securities, the use of smoothed broker dealer quotes, or deliberate performance-smoothing behavior. This could inflate some of the test statistics that we use to make inferences. To allay such concerns, we unsmooth fund returns using the algorithm of Getmansky, Lo, and Makarov (2004) and redo the Table 2 portfolio sort. The results reported in Panel B of Table 8 indicate that our findings are not driven by serial correlation.

4.3. Pre-fee returns

Hedge fund returns are reported net of fees. If funds managed by listed firms charge higher fees than do funds managed by unlisted firms, this can explain the under-performance of the

former. To check, we follow the algorithm outlined in Appendix A of Agarwal, Daniel, and Naik (2009) and back out pre-fee fund returns. As shown in Panel C of Table 8, the baseline portfolio sort spreads are even greater when we analyze pre-fee fund returns.

4.4. Dynamic risk exposures

One concern is that the beta loadings of the fund portfolios perhaps do not stay constant over time. As a result, the risk-adjustment could potentially not be accurate. To account for dynamic factor loadings, we calculate the factor loadings using a rolling 24-month window and use those factor loadings to calculate abnormal returns one-month forward. The results reported in Panel D of Table 8 indicate that inferences remain unchanged after catering for dynamic risk exposures.

4.5. Omitted risk factors

The presence of additional risk factors could cloud inferences from the portfolio sort analysis. Relative to funds managed by listed firms, those managed by unlisted firms could be loading up more on some risk factor (e.g., emerging markets) that did well over the sample period. To ameliorate such concerns, we augment the Fung and Hsieh (2004) model with an emerging markets factor derived from the MSCI Emerging Markets Index return. To cater for exposure to option-based strategies (Mitchell and Pulvino, 2001), we augment the Fung and Hsieh (2004) model with the out-of-the-money S&P 500 call and put option-based factors from the Agarwal and Naik (2004) model. Finally, to account for exposure to liquidity risk (Teo, 2011; Aragon and Strahan, 2012; Sadka, 2012), we supplement the Fung and Hsieh model with the Pástor and Stambaugh (2003) liquidity factor. The results presented in Panels E, F, and G of Table 8 indicate that our baseline results are not driven by omitted risk factors.

4.6. Fund termination

Concerns exist that, because funds that terminated their operations could have stopped reporting returns prematurely, the portfolio alphas are biased upward. To allay such con-

cerns, we assume that, for the month after a fund liquidates, its return is –10%. As shown in Panel H of Table 8, with the adjustment for fund termination, the alphas of the portfolios in the baseline sort fall but the spread remains economically and statistically significant. We also experiment with more extreme termination returns of –20% and –30% and obtain qualitatively similar results.

4.7. Subsample analysis

To understand how the under-performance of funds managed by listed firms varies over time, we split the sample period into two subperiods: January 1994 to December 2003 and January 2004 to December 2013. Next, we redo the Table 2 portfolio sort for each subperiod. The results in Panels I and J of Table 8 indicate that our findings are robust across subperiods.

4.8. Manager manipulation of fund returns

Funds managed by listed firms, due to the higher level of transparency required of them, could be less inclined to inflate their returns than are funds managed by unlisted firms. This could explain the apparent under-performance of the former when we analyze self-reported returns from commercial hedge fund databases. To address this concern, we construct firm returns from firm stock holdings reported in the Thomson Financial 13-F holdings data and redo the baseline portfolio sorts with firm returns. We argue that less scope exists for manipulation in the verifiable 13-F filings data that are reported to the SEC. The number of firms at the end of our sample falls by 88% when we analyze the sample of firm returns derived from stock holdings data.[27] Nonetheless, the results reported in Panel K of Table 8 indicate that our findings remain robust.

[27]Our sample of hedge funds also includes funds that invest exclusively in non-US equities such as European focused funds as well as small equity long/short funds that have less than $100 million in US equity exposure and are therefore not required to report their quarterly holdings to the SEC. In addition, the sample covers other funds that, given their investment style mandate, do not necessarily have single-stock exposure. Examples of such funds are fixed income, distressed debt, and macro funds, as well as commodity trading advisors.

Another way to address manager manipulation is to use the manipulation-proof performance measure (MPPM) proposed by Goetzmann, Ingersoll, Spiegel, and Welch (2007). In that effort, we compute MPPM for the hedge funds in our sample based on rolling 24 months of return information and redo the baseline Eq. (1) regressions with fund MPPM in place of fund alpha. We find that, for all values of $\rho \in \{2, 3, 4\}$ used in the computation of MPPM, the coefficient estimates on *LISTED* in the OLS and Fama and MacBeth (1973) regressions are positive and statistically different from zero at the 1% level.

4.9. Style-adjusted returns

Funds managed by listed firms often engage in different investment strategies relative to funds managed by unlisted firms (see Panel B of Table 1). The Fung and Hsieh model perhaps does not adequately capture the risk exposures of the portfolios in the baseline sort given the heterogeneity in investment styles. In response to such concerns, we redo the baseline portfolio sort with style-adjusted return. Fund style-adjusted return is simply the return of a fund minus the average return of the funds in the same investment style for that month. The results reported in Panel L of Table 8 indicate that the baseline findings are robust to this adjustment.

5. Conclusion

Our empirical results challenge the view that asset management firms go public to enhance investment performance. They indicate that, for an asset management firm, the process of going public separates investment capital from ownership and control, heightening conflicts of interest, which are in turn associated with poorer performance.

We show that hedge funds managed by listed asset management firms consistently underperform funds managed by their unlisted competitors after adjusting for risk. The results are linked to problems that surface from the separation of control and investment capital in a publicly listed firm. Hedge funds that align management and investment capital, such as

funds with high manager total deltas, better governance, and manager co-investment, under-perform less when their management companies go public. The results are also associated with problems that spring from the separation of ownership and investment capital. Asset management firms that are especially prone to short-termist pressures from shareholders under-perform more than do firms that are insulated from such pressures. Consistent with the overall conflicts of interest view, listed management firms with greater separation of ownership, control, and investment capital exhibit more acute under-performance. Relative to funds managed by unlisted firms, those managed by listed firms with low insider ownership and founders who cashed out under-perform more. The conflicts of interest at hedge funds managed by listed firms translate into a tendency to raise capital by growing the AUM of existing and new products. These capital raising activities in turn are associated with under-performance. We show that funds that have the greatest scope for asset gathering, as a consequence of their low liquidity risk levels, also exhibit the most severe under-performance.

The empirical results in this paper enrich our understanding of agency forces at work in the asset management industry. While our work highlights the conflicts of interest that accompany listings of asset management firms, it is important to emphasize that benefits to public listings exist. The capital raised via the IPO can allow firms to market to investors in different geographical regions or make the necessary investments to launch new funds that engage in novel investment strategies. Shareholders benefit from the greater fee revenues generated via the growth of new and existing fund products at listed firms. Fund investors can also derive value from the launch of new funds. Through the new products, they can access different investment strategies and markets with minimal switching costs. Fund investors can appreciate the increased transparency at listed investment management firms. For these reasons, notwithstanding their under-performance, the proportion of industry assets managed by public hedge funds could well continue to grow going forward.

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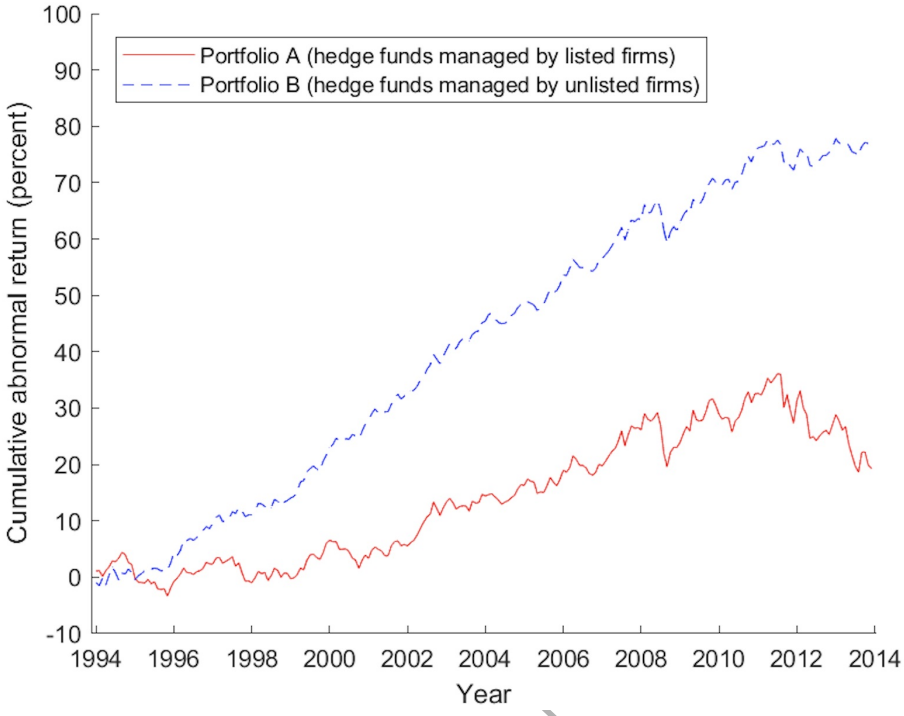

Figure 1: Cumulative abnormal returns of hedge funds managed by listed firms versus hedge funds managed by unlisted firms. Equal-weighted portfolios of hedge funds are constructed by sorting funds based on whether they are managed by listed firms. Cumulative abnormal return is the cumulative difference between a portfolio's excess return and its factor loadings multiplied by the Fung and Hsieh (2004) risk factors. Factor loadings are estimated over the entire sample period. The sample period is from January 1994 to December 2013.

Table 1: Summary statistics

Panel A: Listed versus unlisted firms by year						
	Listed firms			Unlisted firms		
Year	Number of management companies	Number of hedge funds	Total AUM (millions of dollars)	Number of management companies	Number of hedge funds	Total AUM (millions of dollars)
1994	12	39	$2,548	789	1,187	$60,808
1995	20	68	$4,241	886	1,423	$78,583
1996	27	86	$6,822	1,087	1,758	$97,291
1997	32	109	$10,949	1,253	2,069	$138,441
1998	34	100	$11,115	1,366	2,275	$148,410
1999	42	124	$17,539	1,400	2,267	$183,196

2000	49	144	$22,425	1,553	2,590	$210,932
2001	51	156	$27,770	1,682	2,881	$261,629
2002	57	184	$25,256	1,769	3,034	$289,290
2003	65	245	$35,956	1,999	3,522	$421,120
2004	72	295	$53,008	2,215	4,021	$571,768
2005	83	328	$60,948	2,404	4,466	$633,386
2006	100	427	$86,705	2,517	4,652	$834,923
2007	111	523	$123,558	2,567	4,746	$1,041,548
2008	109	451	$75,800	2,362	4,157	$710,135
2009	115	543	$99,171	2,372	4,109	$721,271
2010	110	584	$104,829	2,252	3,915	$811,890
2011	110	700	$125,195	2,047	3,590	$823,782
2012	118	873	$169,988	2,197	3,915	$916,657
2013	113	856	$199,335	2,083	3,662	$995,804

Panel B: Listed versus unlisted firms by investment strategy

	Listed firms		Unlisted firms	
Fund strategy	Number of hedge funds	Percentage of hedge funds	Number of hedge funds	Percentage of hedge funds
Commodity Trading Advisors	87	6.83	1,187	93.17
Emerging Markets	142	16.80	703	83.20
Event Driven	84	7.38	1,054	92.62
Global Macro	159	9.19	1,571	90.81
Long Only	56	29.47	134	70.53
Long/Short	494	9.56	4,674	90.44
Market Neutral	58	13.84	361	86.16
Multi-Strategy	425	24.93	1,280	75.07
Relative Value	243	11.08	1,951	88.92
Sector	43	14.10	262	85.90
Short Bias	3	8.57	32	91.43
Others	32	9.20	316	90.80
Total	1,826	11.89	13,525	88.11

This table reports the number of hedge funds and the total hedge fund assets under management (AUM) managed by listed firms and by unlisted firms in each year (Panel A), and the number and percentage of funds managed by listed firms and by unlisted firms in each investment style (Panel B). We determine fund management company public listing status by leveraging on several sources: Standard & Poor's (S&P) Capital IQ, the Security and Exchange Commission (SEC) Investment Adviser Public Disclosure website, Factiva,

and the fund management companies' websites. For each fund management company, we perform a search in S&P Capital IQ and SEC's Investment Adviser Public Disclosure, which provide information about the company's current and prior corporate parents. Once we identify a parent and subsidiary relation, we obtain the effective public listing date for the fund management company by checking the M&A/Private Placements section in S&P Capital IQ, conducting a Factiva news search, and perusing the corporate history from the fund management company's website. The sample period is from January 1994 to December 2013.

Table 2: Portfolio sorts on fund management company listing status

Portfolio Excess return (percent / year)	Alpha (percent / year)	SNPMRF	SCMLC	BD10RET	BAAMTSY	PTFSBD	PTFSFX	PTFSCOM	Adj. R^2
Panel A: All hedge funds									
Portfolio A (hedge funds managed by listed firms)	4.29* (2.41)	0.96 (0.90)	0.32** (14.35)	0.13** (4.83)	0.11** (2.71)	0.20** (3.99)	-0.01 (-1.18)	0.01 (1.89)	0.01 (0.80)	0.60
Portfolio B (hedge funds managed by unlisted firms)	6.18** (4.32)	3.86** (4.95)	0.24** (14.91)	0.14** (6.86)	0.04 (1.21)	0.17** (4.59)	0.00 (-0.79)	0.01** (3.56)	0.01* (2.23)	0.64
Spread portfolio (A - B)	-1.89** (-3.13)	-2.89** (-4.73)	0.08** (6.10)	0.00 (-0.28)	0.08** (3.20)	0.03 (1.13)	0.00 (-1.06)	0.00 (-1.22)	-0.01 (-1.43)	0.22
Panel B: Hedge funds with AUM greater than $20 million										
Portfolio A (hedge funds managed by listed firms)	3.94* (2.22)	0.63 (0.62)	0.32** (14.71)	0.11** (4.39)	0.10* (2.34)	0.21** (4.43)	-0.01 (-1.76)	0.01 (1.88)	0.01 (1.16)	0.61
Portfolio B (hedge funds managed by unlisted firms)	5.98** (4.03)	3.59** (4.54)	0.24** (14.37)	0.14** (7.05)	0.04 (1.30)	0.18** (4.77)	-0.01 (-1.51)	0.01** (3.16)	0.01* (2.14)	0.63
Spread portfolio (A - B)	-2.04** (-3.54)	-2.95** (-5.46)	0.08** (7.01)	-0.03 (-1.96)	0.05* (2.56)	0.04 (1.46)	0.00 (-1.14)	0.00 (-1.04)	0.00 (-0.91)	0.26

Every January, hedge funds are sorted into two portfolios based on whether they are managed by listed firms or by unlisted firms. The post-formation returns on the two portfolios over the next 12 months are linked across years to form a single return series for each portfolio. Portfolio A is the equal-weighted portfolio of hedge funds managed by listed firms. Portfolio B is the equal-weighted portfolio of hedge funds managed by unlisted firms. In Panel A, we report the results for the full sample of hedge funds. In Panel B, we report the results for hedge funds with assets under management (AUM) greater than $20 million. Hedge fund portfolio performance is estimated relative to the Fung and Hsieh (2004) factors. The Fung and Hsieh (2004) factors are Standard & Poor's (S&P) 500 return minus risk-free rate (SNPMRF), Russell 2000 return minus S&P 500 return (SCMLC), change in the constant maturity yield of the US ten-year Treasury bond appropriately adjusted for the duration of the ten-year bond (BD10RET), change in the spread of Moody's BAA bond over ten-year Treasury bond appropriately adjusted for duration (BAAMTSY), bond PTFS (PTFSBD), currency PTFS (PTFSFX), and commodities PTFS (PTFSCOM), where PTFS is primitive trend following strategy. The t-statistics, derived from White (1980) standard errors, are in parentheses. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.

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Table 3: Regressions on hedge fund performance

	OLS regressions				Fama-MacBeth (1973) regressions			
	RETURN		ALPHA		RETURN		ALPHA	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LISTED	-0.302**(-16.40)	-0.123**(-5.71)	-0.458**(-15.08)	-0.202**(-7.21)	-0.177** (-3.38)	-0.078** (-2.85)	-0.290** (-5.53)	-0.176** (-5.67)
MGTFEE (percent)		0.049**(3.66)		0.015(0.88)		0.049* (2.31)		0.025 (1.11)
PERFFEE (percent)		0.005**(3.93)		0.010**(7.64)		0.007* (2.23)		0.009** (3.43)
NOTICE (months)		0.014**(5.02)		0.013**(4.60)		0.019* (2.56)		0.017* (2.41)
MININV (millions of dollars)		0.001(1.39)		0.000(0.66)		0.003 (1.59)		0.005* (2.09)
log(SIZE)		-0.040**(-10.40)		0.012*(2.42)		-0.046** (-4.38)		0.018 (1.89)
AGE (decades)		-0.138**(-9.12)		-0.083**(-4.62)		-0.201** (-4.23)		-0.130** (-3.53)
Year dummies	No	Yes	No	Yes	No	No	No	No
Strategy dummies	No	Yes	No	Yes	No	Yes	No	Yes
Adj. R-squared	0.000	0.027	0.001	0.010	0.004	0.078	0.004	0.049
Number of observations	834,268	693,145	432,028	376,901	240	240	216	216

This table reports results from multivariate regressions on hedge fund performance. The dependent variables are hedge fund return (RETURN) and alpha (ALPHA). RETURN is hedge fund monthly net of fee return. ALPHA is Fung and Hsieh (2004) seven-factor monthly alpha where factor loadings are estimated over the last 24 months. The primary independent variable of interest is the listed dummy (LISTED). It takes a value of one if the hedge fund is managed by a listed firm and zero otherwise. The other independent variables are hedge fund management fee (MGTFEE), performance fee (PERFFEE), redemption notice period in months (NOTICE), minimum investment in millions of US dollars (MININV), the natural logarithm of fund size (log(SIZE)) where SIZE is in millions of US dollars, fund age in decades (AGE) as well as dummy variables for year and fund investment strategy. The t-statistics for the OLS regressions are derived from robust standard errors that are clustered by fund, and the t-statistics for the Fama-MacBeth regressions are derived from Newey and West (1987) standard errors with a three-month lag to adjust for serial correlation. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.

Table 4: Event study with difference-in-differences analysis

Attribute	Before	After	After - before
Panel A: Hedge fund attributes			
Fund alpha (percent / month), treatment group	0.82	-0.11	-0.93** (-2.81)
Fund alpha (percent / month), control group	0.53	0.30	-0.23 (-1.18)
Difference in alpha (percent / month)	0.29	-0.41	-0.70** (-2.66)
Fund AUM (millions of US dollars), treatment group	270.03	484.97	214.94** (10.75)
Fund AUM (millions of US dollars), control group	289.38	419.91	130.53** (9.38)
Difference in AUM (millions of US dollars)	-19.35	65.06	84.41** (9.79)
Panel B: Fund management company attributes			
Firm alpha (percent / month), treatment group	0.65	-0.08	-0.73** (-3.96)
Firm alpha (percent / month), control group	0.29	0.17	-0.12 (-0.79)
Difference in alpha (percent / month)	0.36	-0.24	-0.60** (-3.12)
Firm AUM (millions of US dollars), treatment group	796.73	1,914.08	1117.35** (16.71)
Firm AUM (millions of US dollars), control group	789.09	1,288.80	499.71** (10.86)
Difference in AUM (millions of US dollars)	7.65	625.27	617.62** (14.49)
Firm fee revenue (millions of US dollars / month), treatment group	2.62	4.30	1.68** (9.94)
Firm fee revenue (millions of US dollars / month), control group	2.55	2.80	0.25 (1.98)
Difference in fee revenue (millions of US dollars / month)	0.06	1.50	1.44** (12.44)
Firm number of funds, treatment group	4.26	8.21	3.95** (28.88)
Firm number of funds, control group	3.84	3.61	-0.23 (-1.30)
Difference in number of funds	0.42	4.61	4.19** (23.94)

This table reports results from an event study analysis of hedge fund and firm attributes

around a fund management company's public listing date. Alpha is Fung and Hsieh (2004) seven-factor monthly alpha with factor loadings estimated over the last 24 months. Event month is the month that the fund management company completes its initial public offering (IPO). The period 'before' is the 60-month period before the event month and the period 'after' is the 60-month period after the event month. To be included in the analysis, a hedge fund or a hedge fund management company must survive at least 36 months before and after the event month. Funds and firms in the control group are matched to funds and firms in the treatment group based on fund alpha, fund assets under management (AUM), firm alpha, firm AUM, firm fee revenue or the number of funds managed by the firm in the 36-month pre-event period. For example, in the fund alpha analysis, funds in the control group are matched to funds in the treatment group by minimizing the sum of the absolute differences in monthly fund alpha in the 36-month pre-event period. Panel A reports results at hedge fund level and Panel B reports results at the fund management company level. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.

Table 5: Probit model on launching new funds

	Dependent variable: NEWFUNDLAUNCHDependent variable: NEWFUNDLAUNCHDependent variable: NEWFUNDLAUNCH	
Independent variable	(1)	(2)
LISTED	0.210**	0.201*
	(2.94)	(2.43)
	[0.0327]	[0.0316]
RETURN (percent)RETURN (percent)RETURN (percent)	0.001	
	(0.36)	
ALPHA (percent)ALPHA (percent)ALPHA (percent)		0.003
		(0.80)
NFUNDS	0.089**	0.086**
	(12.77)	(12.54)
FLOW	-0.000	0.002
	(-1.11)	(0.67)
MGTFEE (percent)MGTFEE (percent)	0.030	0.037
	(1.33)	(1.31)
PERFFEE (percent)PERFFEE (percent)	0.001	0.002
	(0.40)	(0.61)
NOTICE (months)NOTICE (months)	-0.039**	-0.032**
	(-5.53)	(-4.10)
MININV (millions of US dollars)MININV (millions of US dollars)	-0.000	-0.003
	(-1.31)	(-1.48)
AGE (decades)AGE (decades)	-0.319**	-0.295**
	(-8.80)	(-7.25)
log(SIZE)log(SIZE)	0.136**	0.144**
	(14.89)	(13.31)
RETSTD (percent)RETSTD (percent)	0.001	0.005
	(0.20)	(0.61)
Year dummies	Yes	Yes
Pseudo R-squared	0.124	0.139
Number of observations	26,697	19,227

This table reports results from two probit regressions that model the probability of launching new funds for listed and unlisted hedge fund management companies. The dependent variable (NEWFUNDLAUNCH) takes a value of one if the fund management company launches at least one new fund in the year and zero otherwise. All the independent variables are taken from previous year-end. The primary independent variable of interest is the listed dummy (LISTED), which takes a value of one if the hedge fund management company is a listed firm and zero otherwise. The other independent variables are hedge fund firm net of fee return from the previous year (RETURN), hedge fund firm rolling alpha from the previous year (ALPHA), the number of hedge funds managed by the management company in the previous year (NFUNDS), fund flow to the fund management company in the previous year (FLOW), firm management fee (MGTFEE), firm performance fee (PERFFEE), firm redemption notice period in months (NOTICE), firm minimum investment in millions of US dollars (MININV), natural logarithm of firm size (log(SIZE)) where SIZE is in millions of US dollars, firm age in decades (AGE), standard deviation of firm returns in the previous year (RETSTD) and year dummies. Firm-level metrics such as management fee are constructed by value-weighting the fund-level metrics for all funds managed by the firm. The z-statistics, derived from robust standard errors clustered by firm, are in parentheses. The marginal effects are in brackets. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level. This table reports results from two probit regressions that model the probability of launching new funds for listed and unlisted hedge fund management companies. The dependent variable (NEWFUNDLAUNCH) takes a value of one if the fund management company launches at least one new fund in the year and zero otherwise. All the independent variables are taken from previous year-end. The primary independent variable of interest is the listed dummy (LISTED), which takes a value of one if the hedge fund management company is a listed firm and zero otherwise. The other independent variables are hedge fund firm net of fee return from the previous year (RETURN), hedge fund firm rolling alpha from the previous year (ALPHA), the number of hedge funds managed by the management company in the previous year (NFUNDS), fund flow to the fund management company in the previous year (FLOW), firm management fee (MGTFEE), firm performance fee (PERFFEE), firm redemption notice period in months (NOTICE), firm minimum investment in millions of US dollars (MININV), natural logarithm of firm size (log(SIZE)) where SIZE is in millions of US dollars, firm age in decades (AGE), standard deviation of firm returns in the previous year (RETSTD) and year dummies. Firm-level metrics such as management fee are constructed by value-weighting the fund-level metrics for all funds managed by the firm. The z-statistics, derived from robust standard errors clustered by firm, are in parentheses. The marginal effects are in brackets. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level. This table reports results from two probit regressions that model the probability of launching new funds for listed and unlisted hedge fund management companies. The dependent variable (NEWFUNDLAUNCH) takes a value of one if the fund management company launches at least one new fund in the year and zero otherwise. All the independent variables are taken from previous year-end. The primary independent variable of interest is the listed dummy (LISTED), which takes a value of one if the hedge fund management company is a listed firm and zero otherwise. The other independent variables are hedge fund firm net of fee

return from the previous year (RETURN), hedge fund firm rolling alpha from the previous year (ALPHA), the number of hedge funds managed by the management company in the previous year (NFUNDS), fund flow to the fund management company in the previous year (FLOW), firm management fee (MGTFEE), firm performance fee (PERFFEE), firm redemption notice period in months (NOTICE), firm minimum investment in millions of US dollars (MININV), natural logarithm of firm size (log(SIZE)) where SIZE is in millions of US dollars, firm age in decades (AGE), standard deviation of firm returns in the previous year (RETSTD) and year dummies. Firm-level metrics such as management fee are constructed by value-weighting the fund-level metrics for all funds managed by the firm. The z-statistics, derived from robust standard errors clustered by firm, are in parentheses. The marginal effects are in brackets. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.

Table 6: Portfolio sorts on fund management company listing status and conflicts of interests

Portfolio	Excess return		Alpha	
Panel A: Sort on managerial total delta scaled by fund AUM	Low	High	Low	High
Portfolio A (hedge funds managed by listed firms)	3.89(1.83)	6.02** (3.14)	0.38 (0.31)	3.03** (2.49)
Portfolio B (hedge funds managed by unlisted firms)	6.56** (4.25)	6.44** (3.71)	4.29** (5.16)	3.90** (4.20)
Spread portfolio (A - B)	-2.67** (-3.46)	-0.42 (-0.72)	-3.90** (-6.44)	-0.87 (-1.42)
Panel B: Sort on fund aggregate governance score	Low	High	Low	High
Portfolio A (hedge funds managed by listed firms)	1.18 (0.59)	6.88** (3.78)	-1.79 (-1.04)	3.93** (4.49)
Portfolio B (hedge funds managed by unlisted firms)	4.62** (2.78)	7.65** (4.24)	1.87 (1.53)	5.21** (6.98)
Spread portfolio (A - B)	-3.43** (-3.18)	-0.77 (-1.31)	-3.66** (-3.47)	-1.28* (-2.08)
Panel C: Sort on fund manager personal capital	No	Yes	No	Yes
Portfolio A (hedge funds managed by listed firms)	4.38 (1.50)	6.99** (3.31)	-0.88 (-0.39)	4.01** (2.73)
Portfolio B (hedge funds managed by unlisted firms)	6.89** (2.81)	8.51** (3.54)	2.74 (1.87)	4.56** (3.72)
Spread portfolio (A - B)	-2.51* (-2.32)	-1.52 (-1.35)	-3.62** (-3.00)	-0.55 (-0.61)
Panel D: Listed firms sorted by level of insider ownership	Low	High	Low	High
Portfolio A (hedge funds managed by listed firms)	3.60 (1.03)	7.24 (1.10)	0.42 (0.21)	3.04 (0.87)

Portfolio B (hedge funds managed by unlisted firms)	5.28 (1.67)	5.28 (1.67)	2.99 (1.91)	2.99 (1.91)
Spread portfolio (A - B)	-1.69 (-1.97)	1.96 (0.54)	-2.58** (-3.16)	0.05 (0.02)
Panel E: Listed firms sorted by proportion of closely held shares	Low	High	Low	High
Portfolio A (hedge funds managed by listed firms)	3.74* (2.03)	5.48* (2.46)	0.58 (0.51)	1.71 (1.25)
Portfolio B (hedge funds managed by unlisted firms)	6.53** (4.20)	6.53** (4.20)	4.02** (4.86)	4.02** (4.86)
Spread portfolio (A - B)	-2.79** (-4.19)	-1.05 (-0.99)	-3.44** (-5.07)	-2.31** (-2.67)
Panel F: Listed firms sorted by whether existing shareholders cashed out	Yes	No	Yes	No
Portfolio A (hedge funds managed by listed firms)	3.48(0.74)	4.90(1.85)	-1.50(-0.58)	2.80*(2.35)
Portfolio B (hedge funds managed by unlisted firms)	5.60(1.97)	5.60(1.97)	3.08*(2.09)	3.08*(2.09)
Spread portfolio (A - B)	-2.12(-0.94)	-0.71(-0.86)	-4.58**(-2.86)	-0.27(-0.35)

This table reports double-sorts on firm listing status and fund or firm agency proxies. In Panel A, hedge funds are first sorted into two groups based on fund manager total delta scaled by fund assets under management (AUM) (Agarwal, Daniel, and Naik, 2009) computed over the previous year. In Panel B, hedge funds are first sorted into two groups based on their aggregate governance scores (Ozik and Sadka, 2015). As per Ozik and Sadka (2015), high aggregate governance funds are funds with aggregate governance scores = 4 (out of 5), and low aggregate governance funds are funds with aggregate governance scores = 1 (out of 5). In Panel C, hedge funds are first sorted into two groups based on whether the hedge fund manager co-invests in the fund, as measured by the personal capital dummy from the TASS database. Next, funds within each agency metric group are stratified into two portfolios by their fund management company listing status. Portfolio A is the portfolio of hedge funds managed by listed firms. Portfolio B is the portfolio of hedge funds managed by unlisted

firms. In Panels D and E, hedge funds managed by listed firms are sorted based on the level of insider ownership and the number of closely held shares as a proportion of total shares outstanding, respectively. In Panel F, hedge funds managed by listed firms are sorted based on whether their initial public offering (IPO) prospectuses reveal that existing shareholders are cashing out. Information on the level of insider ownership is obtained for listed firms from their Form ADV Schedule A and B filings. Information on the number of closely held shares is obtained from Datastream. IPO prospectuses are obtained from the Perfect Information filings database. The sample period is from January 1994 to December 2013. The effective sample period differs across panels as we also require that each portfolio has at least ten funds. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.

Table 7: Instrumental variable (IV) analysis

	IV first stage (probit)	IV second stage		OLS	
	LISTED	RETURN	ALPHA	RETURN	ALPHA
Dependent variable	(1)	(2)	(3)	(4)	(5)
LISTED		-1.420**	-1.502**	-0.150*	-0.185*
		(-3.95)	(-3.48)	(-2.32)	(-2.41)
MGTFEE (percent)MGTFEE (percent)	-0.051	0.043*	0.048*	0.047*	0.051*
	(-0.56)	(2.19)	(2.18)	(2.44)	(2.41)
PERFFEE (percent)PERFFEE (percent)	0.021**	0.001	0.011**	0.000	0.010**
	(2.71)	(0.54)	(5.21)	(0.03)	(4.85)
NOTICE (months)NOTICE (months)	-0.161**	0.004	0.008	0.009*	0.013**
	(-3.53)	(0.92)	(1.95)	(2.28)	(3.40)
MININV (millions of US dollars)MININV (millions of US dollars)	-0.027	0.002	0.007	0.005	0.010
	(-0.89)	(0.59)	(1.44)	(1.13)	(1.84)
log(SIZE)	0.182**	0.011	0.018**	-0.001	0.006
	(6.78)	(1.76)	(2.59)	(-0.10)	(1.04)
AGE (decades)	-0.216	-0.061*	-0.093**	-0.051	-0.083**
	(-1.45)	(-1.98)	(-2.83)	(-1.74)	(-2.64)
STRATEGYFLOW	0.039**				
	(5.64)				
F-test: STRATEGYFLOW = 0	31.81**				
Year dummies	Yes	Yes	Yes	Yes	Yes
Strategy dummies	Yes	Yes	Yes	Yes	Yes
Pseudo R-squared	0.144				
R-squared		0.032	0.007		
Adj. R-squared				0.034	0.010
Number of observations	257,682	257,682	257,682	257,682	257,682

This table reports results from regressions that use an instrumental variable approach to examine whether the observed differences in hedge fund performance between listed and unlisted hedge fund firms reflect unobserved differences that endogenously determine listing status. Our instrument for listing status exploits the cross sectional differences in hedge

fund managers' ability to accumulate capital at the time of founding. We define hedge fund management company founding strategy fund flow (STRATEGYFLOW) as fund manager's strategy fund flow over the 24-month period after inception. The strategy used in STRATEGYFLOW corresponds to the investment strategy of the first fund launched by the firm. We exclude all listed hedge fund firms that go public less than two years after inception. Column 1 shows the first stage probit model of hedge fund listing status on hedge fund management company founding strategy fund flow (STRATEGYFLOW) and the group of control variables used in Table 3. The dependent variable is the listed dummy (LISTED), which takes a value of one if the hedge fund management company is a listed firm, and a value of zero otherwise. The independent variables are hedge fund management fee (MGTFEE), performance fee (PERFFEE), redemption notice period in months (NOTICE), minimum investment in millions of US dollars (MININV), the natural logarithm of fund size (log(SIZE)) where SIZE is in millions of US dollars, fund age in decades (AGE) and dummy variables for year and fund investment strategy. Following Wooldridge (2010), the second stage is estimated by generalized method of moments (GMM) using as instruments the first-stage predicted probability. Columns 2 and 3 show the second stage results, where the dependent variables are RETURN and ALPHA. RETURN is hedge fund monthly net of fee return. ALPHA is Fung and Hsieh (2004) seven-factor monthly alpha, with factor loadings estimated over the last 24 months. For comparison, Columns 4 and 5 report results from regressions analogous to those reported in Columns 2 and 3 but without instrumenting for hedge fund listing status. In Columns 1, 2, and 3, z-statistics derived from robust standard errors clustered by fund are in parentheses. In Columns 4 and 5, t-statistics derived from robust standard errors clustered by fund are in parentheses. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level. This table reports results from regressions that use an instrumental variable approach to examine whether the observed differences in hedge fund performance between listed and unlisted hedge fund firms reflect unobserved differences that endogenously determine listing status. Our instrument for listing status exploits the cross sectional differences in hedge fund managers' ability to accumulate capital at the time of founding. We define hedge fund management company founding strategy fund flow (STRATEGYFLOW) as fund manager's strategy fund flow over the 24-month period after inception. The strategy used in STRATEGYFLOW corresponds to the investment strategy of the first fund launched by the firm. We exclude all listed hedge fund firms that go public less than two years after inception. Column 1 shows the first stage probit model of hedge fund listing status on hedge fund management company founding strategy fund flow (STRATEGYFLOW) and the group of control variables used in Table 3. The dependent variable is the listed dummy (LISTED), which takes a value of one if the hedge fund management company is a listed firm, and a value of zero otherwise. The independent variables are hedge fund management fee (MGTFEE), performance fee (PERFFEE), redemption notice period in months (NOTICE), minimum investment in millions of US dollars (MININV), the natural logarithm of fund size (log(SIZE)) where SIZE is in millions of US dollars, fund age in decades (AGE) and dummy variables for year and fund investment strategy. Following Wooldridge (2010), the second stage is estimated by generalized method of moments (GMM) using as instruments the first-stage predicted probability. Columns 2 and 3 show the second stage results, where the dependent variables are RETURN and ALPHA. RETURN is hedge fund monthly net of fee return. ALPHA is Fung

and Hsieh (2004) seven-factor monthly alpha, with factor loadings estimated over the last 24 months. For comparison, Columns 4 and 5 report results from regressions analogous to those reported in Columns 2 and 3 but without instrumenting for hedge fund listing status. In Columns 1, 2, and 3, z-statistics derived from robust standard errors clustered by fund are in parentheses. In Columns 4 and 5, t-statistics derived from robust standard errors clustered by fund are in parentheses. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.

Table 8: Robustness tests

Portfolio	Excess Return (percent / year)	Alpha (percent / year)	Adj. R-squared
Panel A: Adjusted for backfill bias			
Portfolio A (hedge funds managed by listed firms)	2.47 (1.31)	-0.62 (-0.53)	0.55
Portfolio B (hedge funds managed by unlisted firms)	4.79** (2.87)	2.19** (2.68)	0.70
Spread portfolio (A - B)	-2.32** (-3.01)	-2.81** (-3.72)	0.05
Panel B: Adjusted for serial correlation			
Portfolio A (hedge funds managed by listed firms)	4.29* (2.41)	0.96 (0.87)	0.60
Portfolio B (hedge funds managed by unlisted firms)	6.18** (4.32)	3.86** (4.93)	0.64
Spread portfolio (A - B)	-1.89** (-3.13)	-2.89** (-5.18)	0.22
Panel C: Pre-fee returns			
Portfolio A (hedge funds managed by listed firms)	7.15** (3.95)	3.83** (3.70)	0.62
Portfolio B (hedge funds managed by unlisted firms)	9.79** (6.66)	7.47** (9.34)	0.63
Spread portfolio (A - B)	-2.64** (-4.55)	-3.64** (-6.43)	0.24
Panel D: Adjusted for dynamic risk exposures using 24-month rolling betas			
Portfolio A (hedge funds managed by listed firms)	4.49* (2.32)	0.02 (0.02)	n.a.
Portfolio B (hedge funds managed by unlisted firms)	6.53** (4.20)	3.44** (3.69)	n.a.
Spread portfolio (A - B)	-2.05** (-3.31)	-3.42** (-4.92)	n.a.
Panel E: Fung and Hsieh (2004) model augmented with an emerging markets equity factor			
Portfolio A (hedge funds managed by listed firms)	4.29* (2.41)	1.68 (1.93)	0.74
Portfolio B (hedge funds managed by unlisted firms)	6.18** (4.32)	4.32** (6.45)	0.73
Spread portfolio (A - B)	-1.89** (-3.13)	-2.64** (-4.61)	0.32

Panel F: Fung and Hsieh (2004) model augmented with the Agarwal and Naik (2004) out-of-the money call and put option factors			
Portfolio A (hedge funds managed by listed firms)	4.29* (2.41)	2.46* (2.41)	0.66
Portfolio B (hedge funds managed by unlisted firms)	6.18** (4.32)	4.56** (5.16)	0.63
Spread portfolio (A - B)	-1.89** (-3.13)	-2.10** (-3.51)	0.25
Panel G: Fung and Hsieh (2004) model augmented with the Pstor and Stambaugh (2003) liquidity factor			
Portfolio A (hedge funds managed by listed firms)	4.29* (2.41)	0.93 (0.80)	0.60
Portfolio B (hedge funds managed by unlisted firms)	6.18** (4.32)	4.28** (5.10)	0.64
Spread portfolio (A - B)	-1.89** (-3.13)	-3.35** (-5.10)	0.23
Panel H: Adjusted for fund termination			
Portfolio A (hedge funds managed by listed firms)	2.84 (1.61)	-0.40 (-0.38)	0.59
Portfolio B (hedge funds managed by unlisted firms)	4.61** (3.23)	2.31** (3.00)	0.64
Spread portfolio (A - B)	-1.77** (-2.95)	-2.72** (-4.45)	0.21
Panel I: Subsample analysis (January 1994 December 2003)			
Portfolio A (hedge funds managed by listed firms)	4.46* (2.44)	1.58 (1.59)	0.72
Portfolio B (hedge funds managed by unlisted firms)	6.59** (4.15)	4.55** (5.25)	0.69
Spread portfolio (A - B)	-2.12** (-2.94)	-2.97** (-3.63)	0.21
Panel J: Subsample analysis (January 2004 December 2013)			
Portfolio A (hedge funds managed by listed firms)	4.11 (1.35)	-0.25 (-0.13)	0.57
Portfolio B (hedge funds managed by unlisted firms)	5.77* (2.43)	2.82* (2.22)	0.66
Spread portfolio (A - B)	-1.66 (-1.71)	-3.07** (-3.17)	0.21
Panel K: Management company returns constructed from 13F stock holdings			

Portfolio A (hedge funds managed by listed firms)	9.19* (2.28)	1.56 (1.83)	0.88
Portfolio B (hedge funds managed by unlisted firms)	12.01** (2.61)	3.73** (3.85)	0.95
Spread portfolio (A - B)	-4.67* (-1.94)	-2.17* (-2.36)	0.38
Panel L: Style-adjusted returns			
Portfolio A (hedge funds managed by listed firms)	-1.65** (-4.45)	-2.24** (-6.02)	0.23
Portfolio B (hedge funds managed by unlisted firms)	-0.34** (-3.16)	-0.23 (-1.92)	0.06
Spread portfolio (A - B)	-1.31** (-2.98)	-2.01** (-4.41)	0.22

This table reports robustness tests on the baseline portfolio sorts. Every January, hedge funds are sorted into two portfolios based on whether they are managed by listed firms or by unlisted firms. The post-formation returns on these two portfolios over the next 12 months are linked across years to form a single return series for each portfolio. Portfolio A is the portfolio of hedge funds managed by listed firms. Portfolio B is the portfolio of hedge funds managed by unlisted firms. Panel A reports results adjusted for backfill bias by removing the return observations before fund listing date. Panel B reports results after unsmoothing returns using the Getmansky, Lo, and Makarov (2004) algorithm. Panel C reports results after adding back fees to form pre-fee returns. Panel D reports results adjusted for dynamic risk exposures by using a rolling 24-month window to calculate factor loadings. Panel E reports results after augmenting the Fung and Hsieh (2004) model with the MSCI Emerging Market Index excess return. Panel F reports results after augmenting the Fung and Hsieh (2004) model with the Agarwal and Naik (2004) out-of-the money call and put option factors. Panel G reports results after augmenting the Fung and Hsieh (2004) model with the Pstor and Stambaugh (2003) liquidity factor. Panel H adjusts for fund termination by assuming that a fund delivers a -10% return for the month after it liquidates. Panels I and J report results for two subsample periods: January 1994 to December 2003 and January 2004 to December 2013, respectively. Panel K reports results with firm returns computed from Thomson Financial 13F stock holdings. Panel L reports results with style-adjusted returns. The t-statistics, derived from White (1980) standard errors, are in parentheses. The sample period is from January 1994 to December 2013. * Denotes significance at the 5% level; ** Denotes significance at the 1% level.